

CLAIMS

1. Apparatus for measuring a characteristic of a web of material by detecting a beta radiation beam after passage through said web of material comprising:

5 a first detector generally aligned with a beta radiation beam to be detected and generating a first signal representative of a first portion of said beam received by said first detector;

a second detector at least partially surrounding said first detector and generating a second signal representative of a second portion of said beam received by said second detector; and

10 a controller receiving said first and second signals and generating a first characteristic signal from said first signal, a second characteristic signal from said second signal and a third characteristic signal from a combination of said first and second signals, wherein said first and second characteristic signals are used to compensate said third characteristic signal for variations in composition of said web of material through which said beta radiation beam passes.

15 2. Apparatus as claimed in claim 1 further comprising at least a third detector at least partially surrounding said first detector and said second detector and generating a third signal representative of a third portion of said beam received by said third detector, said controller further receives said third signal and generating a fourth characteristic signal from said third signal, wherein said first, second and third signals are used to generate said third characteristic
20 signal and said fourth characteristic signal is used to further compensate said third characteristic signal.

3. Apparatus as claimed in claim 1 wherein said characteristic is area weight of said web of material.

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4. Apparatus as claimed in claim 1 wherein said first detector comprises a first plurality of individual beta detectors and said second detector comprises a second plurality of beta detectors.

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5. Apparatus as claimed in claim 1 wherein said first and second detectors comprise an array of individual beta detectors.

6. Apparatus as claimed in claim 5 wherein said first detector comprises a plurality of individual beta detectors of an inner portion of said array and said second detector comprises a plurality of individual beta detectors of an outer portion of said array.

7. Apparatus as claimed in claim 1 wherein said plurality of individual beta detectors of an outer portion of said array at least partially surround said plurality of individual beta detectors of an inner portion of said array.

8. Apparatus as claimed in claim 7 wherein said plurality of individual beta detectors of an outer portion of said array surround said plurality of individual beta detectors of an inner portion of said array.

9. A method for measuring a characteristic of a web of material by detecting a beta radiation beam after passage through said web of material comprising:

generating a first signal representative of a first portion of said beam received by a first detector;

generating a second signal representative of a second portion of said beam received by a second detector;

generating a first characteristic signal from said first signal;

generating a second characteristic signal from said second signal;

generating a third characteristic signal from a combination of said first and second signals; and

using said first and second characteristic signals to compensate said third characteristic signal for variations in composition of said web a sheet of material through which said beta radiation beam passes.

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10. A method for measuring a characteristic of a web of material as claimed in claim 9 further comprising:

generating at least a third signal representative of a third portion of said beam received by a third detector;

5 generating a fourth characteristic signal from said third signal;

said generation of a third characteristic signal from a combination of said first and second signals further comprises generation of said third characteristic signal from a combination of said first, second and third signal; and

10 using said first, second and fourth characteristic signals to compensate said third characteristic signal for variations in composition of said web a sheet of material through which said beta radiation beam passes.

11. A method for measuring a characteristic of a web of material as claimed in claim 9 further comprising:

15 generally aligning said first detector with said beam; and
at least partially surrounding said first detector with said second detector.

12. A method for measuring a characteristic of a web of material as claimed in claim 9 further comprising:

20 forming said first detector as a first plurality of detectors; and
forming said second detector as a second plurality of detectors.

13. A method for measuring a characteristic of a web of material as claimed in claim 9 further comprising:

25 providing a plurality of detectors;
defining said first detector as a first portion of said plurality of detectors; and
defining said second detector as a second portion of said plurality of detectors.

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14. A method for measuring a characteristic of a web of material as claimed in claim 13 further comprising:

generally aligning said first portion of said plurality of detectors with said beam; and
at least partially surrounding said first portion of said plurality of detectors with said
5 second portion of said plurality of detectors.

15. A method for measuring a characteristic of a web of material by detecting a beta radiation beam after passage through said web of material comprising:

generating a first signal representative of a first portion of said beam received by a first
10 detector;

generating a second signal representative of a second portion of said beam received by a
second detector;

measuring a characteristic of an array of first calibration samples with said first detector;
measuring said characteristic of said array of first calibration samples with said second
15 detector;

measuring said characteristic of said array of first calibration samples with a combination
of said first and second detectors;

calibrating said first detector, said second detector and said combination of said first and
second detectors so that each of said first detector, said second detector and said combination of
20 said first and second detectors accurately measure said characteristic of said array of first
calibration samples;

measuring said characteristic of an array of second calibration samples with said first
detector, said array of second calibration samples having a higher atomic number than said array
of first calibration samples;

25 measuring said characteristic of said array of second calibration samples with said second
detector;

measuring said characteristic of said array of second calibration samples with a
combination of said first and second detectors;

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determining a measurement error array equal to a difference between measurements of said characteristic of said array of second calibration samples with a combination of said first and second detectors and laboratory values for said array of second calibration samples;

5 determining a correction signal array equal to a difference between measurements of said characteristic by said first detector and measurements of said characteristic by said second detector;

correlating said measurement error array with said correction signal array to determine measurement errors to be subtracted from characteristic measurements made with a combination of said first and second detectors; and

10 subtracting said measurement errors from said measurements made with a combination of said first and second detectors to determine compensated measurements of said characteristic.

16. A method for measuring a characteristic of a web of material as claimed in claim 15 wherein correlating said measurement error array with said correction signal to determine
15 measurement errors to be subtracted from characteristic measurements made with a combination of said first and second detectors comprises curve fitting said correction signal array to said measurement error array.

17. A method for measuring a characteristic of a web of material as claimed in claim 16
20 wherein said curve fitting comprises using a third order polynomial to fit said correction signal array to said measurement error array.

18. Apparatus for measuring a characteristic of a web of material by detecting a beta radiation beam after passage through said web of material comprising:

25 an inner detector generally aligned with a beta radiation beam to be detected and generating an inner signal representative of an inner portion of said beam received by said first detector;

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at least one outer detector at least partially surrounding said inner detector and generating a corresponding outer signal representative of an outer portion of said beam received by said at least one outer detector; and

a controller receiving said inner and outer signals and generating an inner characteristic signal from said inner signal, an outer characteristic signal from said outer signal and a combined characteristic signal from a combination of said inner and outer signals, wherein said inner and outer characteristic signals are used to compensate said combined characteristic signal for variations in composition of said web of material through which said beta radiation beam passes.

19. Apparatus for measuring a characteristic of a web of material as claimed in claim 18 comprising at least first and second outer detectors.

20. A method for measuring a characteristic of a web of material by detecting a beta radiation beam after passage through said web of material comprising:

generating an inner signal representative of an inner portion of said beam received by an inner detector;

generating at least one outer signal representative of a corresponding portion of said beam received by at least one corresponding outer detector;

generating an inner characteristic signal from said inner signal;

generating at least one outer characteristic signal from said at least one outer signal;

generating a combined characteristic signal from a combination of said inner and outer signals; and

using said inner and outer characteristic signals to compensate said combined characteristic signal for variations in composition of said web a sheet of material through which said beta radiation beam passes.